

Molar Mass and Percent Composition

Calculating Molar Mass

Molar Mass is the mass in grams equal to the sum of all the atomic masses of the component atoms of a substance.

Molar Mass Examples - Elements

- carbon 12.01 g/mol
- aluminum 26.98 g/mol
- zinc 65.39 g/mol

Molar Mass Examples - Compounds

- water
 - H_2O
 - $2(1.00) + 15.99 = 17.99 \text{ g/mol}$
- sodium chloride
 - NaCl
 - $22.99 + 35.45 = 58.44 \text{ g/mol}$

Molar Mass Examples (Compounds)

- sodium bicarbonate
 - NaHCO_3
 - $22.99 + 1.00 + 12.01 + 3(15.99) = 83.97 \text{ g/mol}$
- sucrose
 - $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
 - $12(12.01) + 22(1.00) + 11(15.99) = 342.01 \text{ g/mol}$

Percentage Composition

The percentage by mass of each element in a compound

$$\% \text{ composition} = \frac{\text{mass of element}}{\text{total mass}} \times 100$$

- What is the percent of Carbon in glucose ($C_6H_{12}O_6$)?

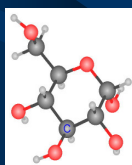
– $C = 12.01 \times 6 = 72.06 \text{ g}$

– $H = 1.008 \times 12 = 12.10 \text{ g}$

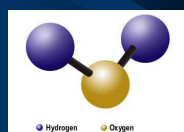
– $O = 16.00 \times 6 = 96.00 \text{ g}$

– Molar mass = 180.16g/ mole of glucose

- $\% C = \frac{72.06 \text{ grams C}}{180.16 \text{ total grams}} \bullet 100\%$
- $\% C = .4000 \bullet 100\%$
- $\% C = 40\%$



- What is the mass % of hydrogen in H_2O ?
- So first you have to find the mass of each atom:
 - Hydrogen = $1.01 \text{ g} \times 2 = 2.02 \text{ g}$
 - Oxygen = $16.00 \text{ g} \times 1 = 16.00 \text{ g}$
 - Total = 18.02 g
- Then you have plug into the equation
- $\% H = \frac{2.016 \text{ g in 1 mole of } H_2O}{18.02 \text{ Total grams in } H_2O} \bullet 100\%$
- $\% H = .1118 \bullet 100\%$
- $\% H = 11.18\%$



Percentage Composition

Find the % composition of Cu_2S .

$$\%Cu = \frac{127.08 \text{ g Cu}}{159.14 \text{ g } Cu_2S} \times 100 = 79.85\% \text{ Cu}$$

$$\%S = \frac{32.06 \text{ g S}}{159.14 \text{ g } Cu_2S} \times 100 = 20.15\% \text{ S}$$

Percentage Composition

- How many grams of copper are in a 38.0-gram sample of Cu_2S ?

Cu_2S is 79.85% Cu

$$(38.0 \text{ g Cu}_2\text{S})(0.7985) = 30.3 \text{ g Cu}$$

Percentage Composition

Find the percentage composition of a sample that is 28 g Fe and 8.0 g O.

$$\% \text{Fe} = \frac{28 \text{ g}}{36 \text{ g}} \times 100 = 78\% \text{ Fe}$$

$$\% \text{O} = \frac{8.0 \text{ g}}{36 \text{ g}} \times 100 = 22\% \text{ O}$$

Percentage Composition

Find the mass percentage of water in calcium chloride dihydrate, $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$?

$$\% \text{H}_2\text{O} = \frac{35.98 \text{ g}}{146.95 \text{ g}} \times 100 = 24.48\% \text{ H}_2\text{O}$$
